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a large number of endophytes, and his study enables him to distinguish four types: (1) type of *Arum maculatum*, hyphae intercellular after traversing the outer cells, their growth arrested by formation of simple terminal haustoria which penetrate the cortical cells; (2) type of *Paris quadrifolia*, hyphae intracellular, of indefinite growth, with complex lateral haustoria arising at definite points; (3) type of Hepaticae, hyphae intracellular, of indefinite growth, entering *via* rhizoids and bearing haustoria transformed into sporangioles; (4) type of Orchideae, hyphae intracellular, of indefinite growth, forming tight pellets which are sometimes permanent and sometimes undergo more or less complete digestion.

There is a remarkable uniformity in the constitution of the cell walls and in the cytological structure. Repeated attempts to isolate the fungi by direct extraction and by inoculation were unsuccessful. The first method failed, probably because the fungus already in was already too much altered by the digestive action of the host, and the second leads the author to distrust utterly the identifications of previous authors. The endophytes, he holds, are *saprophytes internes*, which by their highly differentiated haustoria borrow some non-living nutritive material from the cells in which they live. These cells react very rapidly on the fungus, killing its haustoria, digesting and absorbing them in part; then they resume their normal life, momentarily disturbed. It cannot be said that there is a harmonious symbiosis between the two plants, but rather a conflict between the invading, but little harmful, fungus and the cells which defend themselves by their digestive power.—C. R. B.

Sexual reproduction of *Stigeoclonium*.—PASCHER in an account of the sexual reproduction of *Stigeoclonium fasciculatum*,¹⁸ touches briefly on the formation and behavior of the zoospores (macrospores), which in general agrees with that of other forms, but in a few cases the sporelings developed into filaments of a few cells only, which then formed in each cell a single four-ciliate zoospore (macrospore) that developed like other zoospores. The microspores are four-ciliate and long motile; after losing their motility they become spherical and either form resting-cells, or (rarely) conjugate and form zygotes. The development of the latter was not followed, but from hasty observation he concludes that their germination does not depart from that of the zoospores or the resting-cells. After an indefinite period the resting-cells germinate like the zoospores. Some, however, (akinetes or palmella stage), grow into a few-celled filament, each cell giving rise to four biciliate zoospores, resembling the microspores in size and activity, except that they will not conjugate but germinate at once like the zoospores.

Phylogenetically he claims for *Stigeoclonium fasciculatum* a position midway between *Ulothrix* and *Draparnaldia*, the three kinds of spores indicating that it is on the border-line of sexual reproduction. The same position was long ago claimed by DODEL-PORT for *Ulothrix zonata*. But such generalizations will bear

¹⁸ PASCHER, A., Zur Kenntnis der geschlechtlichen Fortpflanzung bei *Stigeoclonium*. Flora 95: 95-107. figs. 2. 1905.

revision, and investigations of the cytological phenomena involved are especially needed. PASCHER'S observations were microscopic to be sure, but he has apparently attempted no cytological observations at all.—R. THIESSEN.

Sigillarian stems.—Owing to the rarity of sigillarian stems showing structure the description of new specimens is of particular interest to paleobotanists. KIDSTON¹⁹ has given a well-illustrated and adequate description of *Sigillaria elegans*, which differs from the historic *S. Menardi* in that the primary wood of the former is continuous instead of broken up into bundles. The protoxylem is external to the metaxylem, and both are composed of scalariform tracheids. The secondary wood is about equal in thickness to the primary, and shows medullary rays which are mostly one cell thick and one to nine cells high. The outer margin of the primary wood is crenate, and from the furrows arise the leaf traces, of which there are about twenty-eight in a cross section; these do not seem to possess any secondary wood. As is usual in sigillarian stems the pith, phloem, and inner cortex have perished, and the outer cortex contains a broad zone of periderm. *S. elegans*, with a continuous ring of primary xylem, *S. spinulosa*, with a mixture of continuous and discrete xylem, and *S. Menardi*, with separate bundles, form a good series, and judging from the scanty data available it seems that this series represents a sequence in time. The features of *S. elegans* support the view that the genus sprung from forms more like *Lepidodendron*.—M. A. CHRYSLER.

Mycoplasmic propagation of grain rust.—ERIKSSON has published another instalment of his studies on the demonstration of the propagation of grain rust by means of mycoplasma, this time dealing with *Puccinia graminis*.²⁰ Four means are recognized by which the uredo stage of the rust may possibly arise in spring time in winter wheat: (1) from spores of the barberry aecidium, which in turn arose from the resting teleutospores that had remained dormant over winter; (2) direct infection of the wheat plant from the resting teleutospores (homoecism); (3) uredo infection from mycelium remaining alive in the wheat plant over winter; and (4) from endogenous germs of disease (mycoplasma) which pass the winter in a resting condition in the live wheat plant. He marshals a large array of data, drawn from his own observations and experiments and from a wide range of literature, to show that the first method, although it exists, is by no means universal, that the second is highly probable, that the third never occurs in northern regions, if anywhere, and that the fourth is the most common method everywhere. Although the conclusions of the author will not be accepted by most investigators of this difficult problem, yet the array of data is interesting. Two clearly drawn

¹⁹ KIDSTON, ROBERT, On the internal structure of *Sigillaria elegans* of Brongniart's *Histoire des végétaux fossiles*. Trans. Royal Soc. Edinburgh 41:533-550. pls. 1-3. 1905.

²⁰ ERIKSSON, JAKOB, Ueber das vegetative Leben der Getreiderostpilze IV: *Puccinia graminis* Pers. in der heranwachsenden Getreidepflanze. Kungl. Sv. Vet.-Akad. Handl. 39⁵:1-41. pls. 1, 2. 1905.